

**Notice of Allowability**

Application No.

10/720,252

Examiner

Kuen S. Lu

Applicant(s)

LI ET AL.

Art Unit

2167

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Application filed 11/25/2003.
2. ☒ The allowed claim(s) is/are 1-21.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some\* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08),  
Paper No./Mail Date 11/25/2003
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413),  
Paper No./Mail Date 5/11/2003
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☒ Other See Continuation Sheet.

Continuation of Attachment(s) 9. Other: Drawings filed 11/25/2003 are accepted.

### **DETAILED ACTION**

1. This is responsive to Applicant's Application filed November 25, 2003. After a thorough search and examination of the present application and in light of a telephone interview conducted May 11, 2006 in which an Examiner's Amendment was agreed to amend claims 1-21 for resolving potential 35 U.S.C. § 101 and 112th, 2<sup>nd</sup> Paragraph issues and objection to Abstract, Claims 1-21 are allowed.

#### ***Information Disclosure Statement***

2. The information disclosure statement (IDS) filed November 25, 2003 is considered complying with 37 CFR 1.98. 37 CFR 1.98(a)(2) and a signed PTO-1449 is attached.

#### ***Drawings***

3. The Drawings filed on November 25, 2003 have been accepted.

#### ***Examiner's Amendments***

4. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

Authorization for this Examiner's amendment, listed below, was given in a telephone interview with Mr. Ramraj Soundararajan (Registration Number 53,832) on May 11, 2006. The interview summary is attached.

5.1 Please amend Abstract as follow:

#### **ABSTRACT OF THE DISCLOSURE**

A heuristic approach is used to order materialized view (MV) candidates in a list based on descending order of their reduction power. A query (e.g., SQL query) is then matched with the MVs in the list order, wherein searching is stopped ~~as soon as good enough~~ when matching has been found. The query is matched with materialized views in the ordered list by identifying a materialized view candidate as follows: identifying an MV that is not locked by a REFRESH process; identifying a matching MV that does not require a regroup; identifying a matching MV that does not require a rejoin; identifying a matching MV that does not require a residual join; or identifying an MV with largest reduction power from the list of candidates.

**5.2** Please amend claims 1-21 as follow:

1. (Currently Amended) A computer-based method using efficient heuristics in selecting a materialized view (MV) from multiple materialized views matching a query, said method comprising the steps of:
  - (a) receiving a query, Q;
  - (b) ordering materialized view candidates in a list based upon a descending order of reduction powers, wherein reduction power of a material view, M, is a function of cardinalities of common tables between query, Q, and materialized view definition, V, and cardinality of M; and
  - (c) matching a query with materialized views in said ordered list by identifying a materialized view candidate based on any of, or a combination of, the following heuristics: ~~avoid~~ avoiding choosing an MV which is locked by REFRESH process,

choosing a matching that does not require regrouping, choosing a matching that does not require a rejoin, choosing a matching that does not have a residual join, choosing an MV with the largest reduction power, ~~or an equivalent of the foregoing;~~ and  
(d) outputting said materialized view candidate identified in (c).

2. (Currently Amended) A computer-based method using ~~efficient~~ heuristics in selecting a materialized view (MV) from multiple materialized views matching a query, as per claim 1, wherein said query is an SQL query.

3. (Currently Amended) A computer-based method using ~~efficient~~ heuristics in selecting a materialized view (MV) from multiple materialized views matching a query, as per claim 1, wherein said reduction power of a materialized view,  $M$ , is defined as a product of cardinalities of common tables,  $T1$  through  $Tn$ , between query,  $Q$ , and materialized view definition,  $V$ , divided by the cardinality of  $M$ , as given by:  
 $|T1| * \dots * |Tn| / |M|$ .

4. (Currently Amended) A computer-based method using ~~efficient~~ heuristics in selecting a materialized view (MV) from multiple materialized views matching a query, as per claim 1, wherein said method further comprises the steps of:

rewriting said received query based upon identified materialized view candidate; and  
comparing a cost associated with said received query and said rewritten query and  
identifying query with a lower cost; and

executing said query with lower cost.

5. (Currently Amended) A computer-based method using efficient heuristics in selecting a materialized view (MV) from multiple materialized views matching a query, as per claim 1, wherein said matching step further comprises:

(a) looping sorted list of MV candidates starting from first MV candidate as a current candidate;

(b) loading MV definition from catalog;

(c) checking if matching involves regrouping, joining, or residual joining, and, if current MV candidate is locked by REFRESH process;

(d) checking if first matching MV is not a match;

(e) checking and marking if no regrouping match is found;

(f) identifying if no regrouping match was found and if the current MV candidate needs regrouping, and if so, picking best matching MV using said heuristics and if a MV is not picked, marking the picked MV such that during later matching the first matching MV is picked,

whereby abovementioned steps are repeated for each MV candidate in said list.

6. (Currently Amended) A computer-based method using efficient heuristics in selecting a materialized view (MV) from multiple materialized views matching a query, as per claim 5, wherein said method further comprises the steps of:

(a) looping through matched MVs based on reduction power order;

(b) checking if there is regrouping and rejoin matching and if MV is locked by REFRESH processing, else marking current MV as selected MV;

(c) checking if there is regrouping matching and if MV is locked by REFRESH processing, else marking current MV as selected MV;

(d) checking if there is a rejoin matching and residual join matching and if MV is locked by REFRESH processing, else marking current MV as selected MV;

(e) checking if there is a rejoin matching and if MV is locked by REFRESH processing, else marking current MV as selected MV;

(f) checking if there is a residual join matching and if MV is locked by REFRESH processing, else marking current MV as selected MV,

whereby abovementioned steps are repeated for each MV candidate until an MV is picked and outputted.

7. (Currently Amended) A computer-based method using ~~efficient~~ heuristics in selecting a materialized view (MV) from multiple materialized views matching a query, as per claim 1, wherein said method is implemented across one or more networks.

8. (Currently Amended) A computer-based method using ~~efficient~~ heuristics in selecting a materialized view (MV) from multiple materialized views matching a query, as per claim 7, wherein network is any of the following: local area network, wide area network, or the Internet.

9. (Currently Amended) An article of manufacture comprising a computer usable medium having computer readable program code embodied therein which implements efficient heuristics to select a materialized view (MV) from multiple materialized views matching a query, said medium comprising:

- (a) computer readable program code aiding in receiving a query,  $Q$ ;
- (b) computer readable program code ordering materialized view candidates in a list based upon a descending order of reduction powers, wherein reduction power is a function of cardinalities of common tables between query,  $Q$ , and materialized view definition,  $V$ , and cardinality of  $M$ ; and
- (c) computer readable program code matching a query with materialized views in said ordered list by identifying a materialized view candidate based on any of, or a combination of, the following heuristics: avoid choosing an MV which is locked by REFRESH process, choosing a matching that does not require regrouping, choosing a matching that does not require a rejoin, choosing a matching that does not have a residual join, choosing an MV with the largest reduction power, ~~or an equivalent of the foregoing; and~~
- (d) outputting said materialized view candidate identified in (c).

10. (Currently Amended) An article of manufacture comprising a computer usable medium having computer readable program code embodied therein which implements efficient heuristics to select a materialized view (MV) from multiple materialized views matching a query, as per claim 9, wherein said reduction power of a materialized view,



$M$ , is defined as a product of cardinalities of common tables,  $T_1$  through  $T_n$ , between query,  $Q$ , and materialized view definition,  $V$ , divided by the cardinality of  $M$ , as given by:

$$|T_1| * \dots * |T_n| / |M|.$$

11. (Currently Amended) An article of manufacture comprising a computer usable medium having computer readable program code embodied therein which implements efficient heuristics to select a materialized view (MV) from multiple materialized views matching a query, as per claim 9, wherein said medium further comprises:

- (a) computer readable program code looping sorted list of MV candidates starting from first MV candidate as a current candidate;
- (b) computer readable program code loading MV definition from catalog;
- (c) computer readable program code checking if matching involves regrouping, joining, or residual joining, and, if current MV candidate is locked by REFRESH process;
- (d) computer readable program code checking if first matching MV is not a match;
- (e) computer readable program code checking and marking if no regrouping match is found;
- (f) computer readable program code identifying if no regrouping match was found and if the current MV candidate needs regrouping, and if so, picking best matching MV using said heuristics and if a MV is not picked, marking the picked MV such that during later matching the first matching MV is picked,

whereby computer readable program code repeats abovementioned steps for each MV candidate in said list.

12. (Currently Amended) An article of manufacture comprising a computer usable medium having computer readable program code embodied therein which implements efficient heuristics to select a materialized view (MV) from multiple materialized views matching a query, as per claim 11, wherein said medium further comprises:

(a) computer readable program code looping through matched MVs based on reduction power order;

(b) computer readable program code checking if there is a regrouping and rejoin matching and if MV is locked by REFRESH processing, else marking current MV as selected MV;

(c) computer readable program code checking if there is a regrouping matching and if MV is locked by REFRESH processing, else marking current MV as selected MV;

(d) computer readable program code checking if there is a rejoin matching and residual join matching and if MV is locked by REFRESH processing, else marking current MV as selected MV;

(e) computer readable program code checking if there is a rejoin matching and if MV is locked by REFRESH processing, else marking current MV as selected MV;

(f) computer readable program code checking if there is a residual join matching and if MV is locked by REFRESH processing, else marking current MV as selected MV,

whereby computer readable program code repeats abovementioned steps for each MV candidate until an MV is picked.

13. (Currently Amended) An article of manufacture comprising a computer usable medium having computer readable program code embodied therein which implements ~~efficient~~ heuristics to select a materialized view (MV) from multiple materialized views matching a query, as per claim 9, wherein said query is an SQL query.

14. (Currently Amended) A computer-based method using ~~efficient~~ heuristics in selecting a materialized view (MV) from multiple materialized views matching a query, said method comprising the steps of:

- (a) receiving a query,  $Q$ ;
- (b) ordering materialized view candidates in a list based upon a descending order of reduction powers, wherein reduction power of a materialized view,  $M$ , is defined as a product of cardinalities of common tables,  $T1$  through  $Tn$ , between query,  $Q$ , and material definition,  $V$ , divided by the cardinality of  $M$  as given by:

$|T1| * \dots * |Tn| / |M|$ ; and

- (c) matching a query with materialized views in said ordered list by identifying a materialized view candidate not locked by a REFRESH process, said matching performed until a materialized view candidate is identified as follows:

identifying an MV candidate as a matching MV that does not require a regrouping, else;

identifying an MV candidate as a matching MV that does not require a rejoin,  
else;

identifying an MV candidate as a matching MV that does not require a  
residual join, else;

identifying an MV candidate as an MV with largest reduction power from said  
list of candidates; and

(d) outputting said identified materialized view candidate in (c).

15. (Currently Amended) A computer-based method using ~~efficient~~ heuristics in  
selecting a materialized view (MV) from multiple materialized views matching a query,  
as per claim 14, wherein said method further comprises the steps of:

rewriting said received query based upon identified materialized view candidate; and  
comparing a cost associated with said received query and said rewritten query and  
identifying query with a lower cost; and  
executing said query with lower cost.

16. (Currently Amended) A computer-based method using ~~efficient~~ heuristics in  
selecting a materialized view (MV) from multiple materialized views matching a query,  
as per claim 14, wherein said query is an SQL query.

17. (Currently Amended) A computer-based method using ~~efficient~~ heuristics in selecting a materialized view (MV) from multiple materialized views matching a query, as per claim 14, wherein said method is implemented across one or more networks.

18. (Currently Amended) A computer-based method using ~~efficient~~ heuristics in selecting a materialized view (MV) from multiple materialized views matching a query, as per claim 17, wherein network is any of the following: local area network, wide area network, or the Internet.

19. (Currently Amended) An article of manufacture comprising a computer usable medium having computer readable program code embodied therein which implements ~~efficient~~ heuristics to select a materialized view (MV) from multiple materialized views matching a query, said medium comprising:

- (a) computer readable program code aiding in receiving a query,  $Q$ ;
- (b) computer readable program code ordering materialized view candidates in a list based upon a descending order of reduction powers, wherein reduction power of a materialized view,  $M$ , is defined as a product of cardinalities of common tables,  $T1$  through  $Tn$ , between query,  $Q$ , and materialized view definition,  $V$ , divided by the cardinality of  $M$  as given by:

$|T1| * \dots * |Tn| / |M|$ ; and

- (c) computer readable program code matching a query with materialized views in said ordered list by identifying a materialized view candidate not locked by a REFRESH

process, said matching performed until a materialized view candidate is identified as follows:

computer readable program code identifying an MV candidate as a matching MV that does not require regrouping, else;

computer readable program code identifying an MV candidate as a matching MV that does not require a rejoin, else;

computer readable program code identifying an MV candidate as a matching MV that does not require a residual join, else;

computer readable program code identifying an MV candidate as an MV with largest reduction power from said list of candidates; and

(d) computer readable program code aiding in outputting said identified materialized view candidate in (c).

20. (Currently Amended) An article of manufacture comprising a computer usable medium having computer readable program code embodied therein which implements efficient heuristics to select a materialized view (MV) from multiple materialized views matching a query, as per claim 19, wherein said medium further comprises:

computer readable program code rewriting said received query based upon identified materialized view candidate; and

computer readable program code comparing a cost associated with said received query and said rewritten query and identifying query with a lower cost; and

computer readable program code executing said query with lower cost.

21. (Currently Amended) An article of manufacture comprising a computer usable medium having computer readable program code embodied therein which implements efficient heuristics to select a materialized view (MV) from multiple materialized views matching a query, as per claim 19, wherein said query is an SQL query.

***Reason for Allowable***

6. The following is an examiner's statement of reasons for allowance:

After a thorough search for the prior art conducted on EAST database and domains (NPL-ACM, Google, NPL-IEEE), and a detailed examination of the search results, the Examiner is persuaded that the prior art searched and made of record in the attached PTO-892 does not teach the subject matter of **selecting a materialized view from candidates in a list based upon descending reduction power, a function of cardinalities of query tables and candidate materialized views, and further upon a heuristics of choosing the view based on not under locking for refresh, matching not requiring regrouping, matching not requiring rejoin, matching not having residual rejoin and the maximum reduction power**, as described in the claims amended by Examiner's Amendment as listed above in each of the independent claims 1, 9, 14 and 19.

The dependent claims in the groups (2-8), (10-13), (15-18) and (20-21), depending on claims 1, 9, 14 and 19, respectively, also distinct from the prior art for the same reason.

7. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

***Contact Information***


4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kuen S Lu whose telephone number is (571) 272-4114. The examiner can normally be reached on Monday-Friday (8:00 am-5:00 pm). If attempts to reach the examiner by telephone are unsuccessful, the examiner's Supervisor, John Cottingham can be reached on (571) 272-7079. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for Page 13 published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 886-217-9197 (toll-free).




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Kuen S. Lu 

Patent Examiner

May 11, 2006

  
JOHN R. COTTINGHAM  
PRIMARY EXAMINER

